**Abstract**

We study the prospects for detecting gamma-rays from point sources of Dark Matter annihilation with the space satellite GLAST. We simulate the instrument response to the gamma-ray spectrum arising from the annihilation of common Dark Matter candidates, and derive full-sky sensitivity maps for the detection of point sources and for the identification of the Dark Matter (as opposed to astrophysical) origin of the gamma-ray emission. These maps represent a powerful tool to assess the detectability of point sources, i.e. sources with angular size smaller than the angular resolution of GLAST, ~ 0.1 degrees, in any DM scenario. As an example, we apply the obtained results to the so-called 'mini-spikes' scenario, where the annihilation signal originates from large Dark Matter overdensities around Intermediate Mass Black Holes. We find that if these objects exist in the Galaxy, not only GLAST should be able to detect them over a timescale as short as 2 months, but in many cases it should be possible to determine with good accuracy the mass of the annihilating Dark Matter particles, while null searches would place stringent constraints on this scenario.

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**GLAST Sensitivity Map**

GLAST is expected to play a crucial role in indirect DM searches, thanks both to its ability to perform observations at energy scales comparable to the mass of common DM candidates and to its potential of making deep full-sky maps in gamma-rays, thanks to its large field-of-view. Here, we study the prospects for detecting point sources of DM annihilation with GLAST, and assess the possibility to discriminate them from nearby astrophysical sources.

1. We specify a Dark Matter candidate, and estimate the relevant annihilation spectrum. In the figure above, the annihilation spectra relative to different leading annihilation channels are shown. Below, we show sensitivity maps for annihilation into bino-quarks.

2. We divided the sky into regions of about 10 degrees in radius, and in each region we placed one DM source.

3. We considered each source separately and let the flux intensity vary up and down.

4. We calculated the significance of the observed signal, given the local background counts, with a maximum likelihood analysis assuming Poisson statistics.

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**Sensitivity Maps**

By estimating the minimum flux (above 100 MeV) required to discriminate the DM source from the background at a 5σ level on a grid of points uniformly distributed over the sky, we have obtained the first of the sensitivity maps shown below (where we adopted a DM particle mass $m = 150$ GeV). The sensitivity appears to depend significantly on the Galactic longitude, as expected. At high galactic latitudes a source as faint as $10^{-9} \text{ph m}^{-2} \text{s}^{-1}$ is required, while close to the galactic center a minimum flux of $10^{-7} \text{ph m}^{-2} \text{s}^{-1}$ is reached.

In a similar way, we can also produce a sensitivity map for a reliable identification of the DM gamma-ray sky. We derive full-sky sensitivity maps for the GLAST sensitivity map for the simulated gamma-ray sky (see the caption above for further details). Assuming a DM particle with mass $m = 150$ GeV, we have obtained the first of the sensitivity maps shown below (where we adopted a DM particle mass $m = 150$ GeV). The sensitivity appears to depend significantly on the Galactic longitude, as expected. At high galactic latitudes a source as faint as $10^{-9} \text{ph m}^{-2} \text{s}^{-1}$ is required, while close to the galactic center a minimum flux of $10^{-7} \text{ph m}^{-2} \text{s}^{-1}$ is reached.

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**Application to Mini-Spikes**

Although it is unlikely that a spike will survive, the Super-massive Black Hole at the Galactic center, they can evolve unperturbed around Intermediate Mass Black Holes (IMBHs).i.e. containing holes with masses comprised between a hundred and a million solar masses.[3] Below, a mock catalog of mini-spikes in Galactic coordinates.[3]

- **Black Holes can be broadly classified in 3 categories, based on their mass:**
  - 10$^9$ M$_\odot$ or 10$^8$ M$_\odot$ or 10$^6$ M$_\odot$.
  - Stellar Mass Holes
  - Intermediate Mass Holes
  - Supermassive Holes

The (adiabatic) growth of a massive object inevitably affects the surrounding distribution of matter, and if the surrounding distribution of Dark Matter is distributed similarly at the center of a Virgo-like galaxy, the final distribution will be a steeper power law of index $\gamma = 2 - 3$. Such a concentration of DM is called 'spike'.

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**References:**

[1] This poster is based on astro-ph/0612387. See ibid. for a full set of references
